

REMARKS

Claims 1, 2 and 4-47 are pending in this application. By this Amendment, claims 1, 4, 5, 7, 8, 11, 14, 17, 18, 21, 24, 27, 28, 31, 34, 37, 38, 41 and 47 are amended. No new matter is added.

I. Claim Rejections Under 35 U.S.C. §103

Claims 1, 2, 4, 13, 44 and 45 are rejected under 35 U.S.C. §103(a) as unpatentable over U.S. Patent No. 5,470,491 to Kodama et al. (Kodama) in view of U.S. Patent No. 5,139,904 to Auda et al. (Auda) and further in view of U.S. Patent No. 5,604,073 to Krounbi et al. (Krounbi); claim 2 is rejected under 35 U.S.C. §103(a) as unpatentable over Kodama in view of Auda, further in view of Krounbi and further in view of U.S. Patent No. 5,811,358 to Tseng et al. (Tseng); claims 5, 16, 26 and 36 are rejected under 35 U.S.C. §103(a) as unpatentable over Kodama further in view of Krounbi and further in view of U.S. Patent No. 5,820,770 to Cohen et al. (Cohen) and further in view of U.S. Patent No. 5,721,078 to Kamijima; claims 6-8 are rejected under 35 U.S.C. §103(a) as unpatentable over Kodama in view of Auda, further in view of Krounbi and further in view of either Kamijima or U.S. Patent No. 4,444,869 to Chonan et al. (Chonan); claim 9 is rejected under 35 U.S.C. §103(a) as unpatentable over Kodama in view of Auda, further in view of Krounbi and further in view of Cohen and either Chonan or Kamijima; claims 10 and 11 are rejected under 35 U.S.C. §103(a) as unpatentable over Kodama in view of Auda, further in view of Krounbi and further in view of U.S. Patent No. 4,894,311 to Uenishi et al. (Uenishi); claim 12 is rejected under 35 U.S.C. §103(a) as unpatentable over Kodama in view of Auda, Krounbi and further in view of Cohen, further in view of Kamijima, and further in view of Uenishi; claims 14, 24, 34 and 46 are rejected under 35 U.S.C. §103(a) as unpatentable over Kodama in view of Auda, further in view of Krounbi and further in view of either Cohen or Kamijima; claims 15, 25 and 35 are rejected under 35 U.S.C. §103(a) as unpatentable over Kodama in view of

Auda, further in view of Krounbi and further in view of Cohen and Tseng; claims 17, 18, 27, 28, 37 and 38 are rejected under 35 U.S.C. §103(a) as unpatentable over Kodama in view of Auda, further in view of Cohen and further in view of either Chonan or Kamijima; claims 19, 29 and 39 are rejected under 35 U.S.C. §103(a) as unpatentable over Kodama in view of Auda, further in view of Cohen and further in view of either Chonan or Kamijima and further in view of Tseng; claims 20, 30 and 40 are rejected under 35 U.S.C. §103(a) as unpatentable over Kodama in view of Auda, further in view of Cohen and further in view of either Chonan or Kamijima; claims 21, 31 and 41 are rejected under 35 U.S.C. §103(a) as unpatentable over Kodama in view of Auda, further in view of Cohen and further in view of Uenishi; claims 22, 32 and 42 are rejected under 35 U.S.C. §103(a) as unpatentable over Kodama in view of Auda, further in view of Cohen and further in view of Uenishi and Tseng; claims 23, 33 and 43 are rejected under 35 U.S.C. §103(a) as unpatentable over Kodama in view of Auda, further in view of Cohen and further in view of Kamijima and Uenishi; and claim 47 is rejected under 35 U.S.C. §103(a) as unpatentable over Kodama in view of Auda, further in view of Uenishi. The rejections are respectfully traversed.

None of the applied references, whether considered alone or in combination, disclose or suggest each and every feature recited in the rejected claims. For example, the combination of references fails to disclose or suggest a method for fabricating a resist pattern narrowed below an optically theoretical limitation, comprising forming a pre-resist pattern through exposure treatment and development treatment, the pre-resist pattern being made of a photoresist layer as a top layer and polymethylglutarimide layer as a bottom layer, increasing bond strength between the pre-resist pattern and a base material by increasing an amount of relative contact area of the pre-resist pattern and the base material by ash-treating the pre-resist pattern, and ash-treating the pre-resist pattern to form the narrowed resist pattern, as recited in amended claim 1, and the similar features of the remaining pending claims.

The Office Action admits that Kodama does not teach a pattern photoresist that is narrowed by ashing. To overcome the admitted deficiency the Office Action combines Auda for its disclosure of using a reactive ion etching (RIE) tool for ashing a resist layer, as shown in Fig. 2C of Auda. The Office Action alleges that it would have been obvious to one of ordinary skill in the art to employ the ashing technique disclosed in Auda to decrease the overall dimensions of the photoresist pattern 17A.

Auda discloses that by using the RIE tool, during isotropic cuts of the pattern, the thickness of the photoresist pattern is reduced simultaneously with the lateral dimensions (col. 5, lines 50-66). Thus, although Auda discloses the simultaneous reduction in the thickness and lateral dimensions of the resist pattern, such a reduction would not result in a narrowed resist pattern that is narrowed below an optically theoretical limitation. Auda is also silent regarding the use of such a tool to achieve the resulting narrowed resist pattern as claimed.

Furthermore, none of the combination of references discloses or suggests increasing the bond strength between the pre-resist pattern and a base material by increasing the relative contact area of the pre-resist pattern and the base material by ash treating the pre-resist pattern.

As recited in the related art statement of this application, the problem being addressed is limitations on providing a minute resist pattern beyond an optically theoretical limitation through the use of illumination beams used in the exposure process. Additionally, previous attempts to narrow the resist pattern through a T-shaped or reversed trapezoid resist pattern are known to be unsuccessful due to the reduced contact area between the resist pattern and the base material caused by the T-shaped or reversed trapezoidal shape of the resist pattern. The reduced contact area resulted in a degradation of the adhesive strengths between the resist pattern and the base material which often caused the resist pattern to be broken away at the

development process. Accordingly, creating a limit resist pattern narrowed to a size smaller than an optically theoretical limitation was thought to be unachievable.

The subject matter recited in the pending claims provides a method for increasing the bond strength between the pre-resist pattern and the base material by increasing the relative contact area of the pre-resist pattern and the base material by ash treating the pre-resist pattern and ash treating the pre-resist pattern to form a narrowed resist pattern narrowed below an optically theoretical limitation.

Although, Auda may disclose use of an ashing treatment to simultaneously reduce the thickness and width dimensions of the pre-resist layer, Auda does not contemplate increasing the bond strength through such as technique. Furthermore, none of the applied references of record contemplate a method for narrowing a resist pattern below an optically theoretical limitation through the use of ash-treating. Accordingly, there is no suggestion in any of the references to make the combination as proposed in the Office Action.

As indicated in the related art statement, only a wider resist pattern has to date been able to be fabricated and thus, only a wider thin film pattern could be created using such a resist pattern. In other words, the subject matter of this invention allows minute resist patterns to be fabricated that are beyond the previously known optically theoretical limitation. Accordingly, although methods for ash treating are known, there is no suggestion in any of the references to use ash treating on a pre-resist pattern to form a narrowed resist pattern below an optically theoretical limitation. Additionally, by using the ash-treating methodology to increase the relative contact area of the pre-resist pattern and the base material, the resist pattern is less likely to be broken away during the development process and thus the thin film patterning can be carried out.

To suggest that the claimed methods of forming resist patterns and patterning thin films using these techniques is known or obvious is to engage in the impermissible case of hindsight. Accordingly, it is requested that the rejection of the pending claims be withdrawn.

II. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,


James A. Oliff
Registration No. 27,075

John W. Fitzpatrick
Registration No. 41,018

JAO:JWF/ldg

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OLIFF & BERRIDGE, PLC
P.O. Box 19928
Alexandria, Virginia 22320
Telephone: (703) 836-6400

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